1,154,754

PATENT SPECIFICATION

DRAWINGS ATTACHED

1,154,754

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COMPLETE SPECIFICATION

Improvements in Cutting Tool Inserts

We, GENERAL ELECTRIC COMPANY, a corporation organised and existing under the laws of the State of New York, United States of America, of 1 River Road, Schenectady 12305, State of New York, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to cutting inserts which are indexable to place a fresh cutting edge of one face into cutting position when the previously so positioned cutting edge of the face is no longer serviceable and which is invertible so that it may be indexed to various cutting edges about an opposite face and, more specifically, to an invertible and indexable insert particularly suited for heavy-duty cutting and including raised portions adjacent the cutting edges of each face whereby the direction of travel of material removed from a workpiece is efficiently controlled so that it may be effectively broken into chips.

In the machining of a workpiece with cutting tools utilizing inserts of the instant type, a ribbon of material is removed by engaging a cutting edge of the insert with the workpiece. As is well known in the art, one of the primary problems associated with such machining operations is that the ribbon of material removed from the workpiece must be controlled so as to break into short controllable lengths or chips so that the removed material does not interfere with the cutting operation. The control of the ribbon of material removed from the workpiece to break it into chips is particularly difficult in heavy-duty cutting wherein a very thick ribbon is removed from the workpiece. Such heavy-duty cutting occurs whenever the feed is approximately 0.030 inch or larger and the depth of cut is greater than about 1/2 inch. That is to say, heavy-duty cutting is involved whenever the thickness of the ribbon of material removed from the workpiece, i.e., the thickness of the chips, is more than approximately 0.030 inch thick and the width is 1/2 inch or more. Generally speaking, the chip control devices heretofore utilized for heavy-duty cutting are proportionately less satisfactory as the feed increases, i.e., as the thickness of the ribbon of material removed from the workpiece increases.

In general, the advantages of this invention may be attained by a preferred embodiment including a shank having a pocket at one end with an invertible and indexable disposable cutting insert disposed in the pocket. The cutting insert includes a pair of spaced substantially parallel sides and a peripheral surface disposed therebetween comprising a plurality of flat edge surfaces at least some of the junctured of said flat edge surfaces with said parallel sides defining straight cutting edges, said insert having a flat-surfaced planar recess on both of said sides extending between raised portions of said sides the cutting edges being at the peripheral edge of the raised portions of said parallel sides. An appropriate fastener mounts the insert in the pocket in the shank. Thus, the shank may be positioned adjacent a workpiece so that a cutting edge of the insert enlages the workpiece whereby the material removed from the workpiece curls and breaks into chips as it moves across the raised portion extending from the cutting edge.

The invention can be better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

FIGURE 1 is a fragmentary view showing a preferred embodiment of the instant invention in cutting relationship with a workpiece;

FIGURE 2 is an enlarged perspective view of a preferred embodiment of the insert of the instant invention;

FIGURE 3 is an enlarged fragmentary crosssectional view showing the position of a chip relative to the cutting edge as it is removed from the workpiece; and

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FIGURE 4 is an enlarged perspective view showing another embodiment of the insert of the instant invention.

Referring now to the drawings, wherein like numerals indicate like or corresponding parts throughout the several views, a preferred embodiment of the cutting tool of the instant invention is generally shown at 10. The cutting tool includes a shank 12 which has a pocket at one end, which pocket is generally indicated at 14. An invertible and indexable disposable cutting insert is generally shown at 16 and is mounted in the pocket 14 by an appropriate means, such as the fastener indicated in phantom at 18. The insert 16 may be secured in the pocket 14 of the shank 12 by a fastener of the type disclosed in U.S. patent 3,097,417 or of the type disclosed in U.S. Patent No. 3,341,920. In addition, the insert 16 may be disposed on a seat (not shown) in the pocket 14 in a manner as disclosed and claimed in British Application No. 5521/67 (Serial No. 1154753). The insert 16 in FIGURE 1 is shown in cutting engagement with the workpiece 20 and a chip 22, which is being removed from the workpiece 20, is shown in phantom.

As more clearly shown in FIGURE 2, insert 16 includes a pair of spaced parallel sides which are generally shown at 30 and 32 and described more fully below. A peripheral surface extends between the sides 30 and 32 and includes a first pair of flat edge surfaces 34 and a second pair of flat edge surfaces 36 (one edge surface 34 and one edge surface 36 not being shown). The first pair of edge surfaces 34 are parallel to one another, and the second pair of edge surfaces 36 are parallel to one another and are perpendicular to and interconnect the first pair of edge surfaces 34.

The junctures of the side face 30 and the edge surfaces 34 define the cutting edges 38 and 40. The junctures of the side face 32 and the edge surfaces 34 define the cutting edges 42 and 44. As illustrated in FIGURE 1, the insert 16 is mounted in the pocket 14 so that one of the cutting edges is positioned to engage and remove material from the workpiece 20.

The insert 16 includes a first flat surfaced planar recess 46 disposed on the side 30 in spaced relationship to the cutting edges 38 and 40 for defining the raised portions 48 and 50. The raised portion 48 extends between the cutting edge 38 and the recess 46 and the raised portion 50 extends between the cutting edge 40 and the recess 46. The second side 32 includes a second flat surfaced planar recess 52 to define and extend between the raised portions 54 and 56, which are associated with the side 32. The insert 16, therefore, includes four cutting edges as defined by the junctures of the edge surfaces 34 and the sides 30 and 32, and the recesses 46 and 52 extend between and intersect the edge surfaces 36 to define a pair of raised portions for each of the sides 30 and 32; hence, each of the edge surfaces 36 is substantially H-shaped. It will, therefore, be observed that the insert 16 has a substantially H-shaped cross section as defined by a plane perpendicular to any one of the cutting edges and passing through the insert.

The insert 16 also includes a hole 58 through which the fastener 18 may be disposed to secure the inserts 16 in the pocket 14 of the shank 12. As is well known in the art, the position in which an insert is mounted determines the position of the surfaces defining the cutting edge and this position may be controlled so that the cutting tool has a positive or a negative rake. In addition, the angle between the surfaces defining each cutting edge of an insert also may be controlled to determine the rake of the particular insert, whether it be positive or negative. Accordingly, each of the raised portions 48, 50, 54 and 56 includes an upper flat surface extending from the associated cutting edge toward the adjacent recess, and, although the surface may be disposed parallel to the flat surface of the recess 46, i.e., perpendicular to the edge surfaces, it also may be disposed at an acute angle with the surface of the adjacent recess for providing positive and negative rakes. As illustrated in FIGURE 2, the upper flat surfaces of the raised portions 48, 50, 54 and 56 are disposed at an acute angle with the surface of the adjacent recesses by being angled downwardly towards said recess surface from the respective cutting edges; however, the respective surfaces may also be at an acute angle with the adjacent recesses by being inclined upwardly from the associated cutting edges.

As illustrated in FIGURE 3, the shank may be disposed adjacent a workpiece to position a cutting elge 38 for engaging a workpiece so that material removed from the workpiece is curled as shown at 22 as it moves across the raised portion 48 which is adjacent to and extends from the cutting edge 38. In heavy-duty cutting where the tool feed is more than approximately 0.030 inch such that the chip thickness is more than approximately 0.030 inch thick, the chips will curl and break off in the desired sizes by utilizing an insert having a raised portion adjacent to and extending from the cutting edge thereof. The utilization of the insert 16 also reduces the heat generation during the chip formation as compared to previously known inserts. Thus the instant invention provides an insert which efficiently cuts and results in reduced tool wear and breakage.

The insert, generally shown at 60 in FIGURE 4, is an embodiment which is invertible and indexable and includes a pair of spaced sides, one of which is generally shown at 62. A peripheral surface extends between the side faces 62 and includes a first pair of edge surfaces 64, which are parallel to one another, and a second pair of edge surfaces 66,

which are parallel to one another. The second pair of edge surfaces 66 are perpendicular to and interconnect the first pair of edge surfaces 64. The insert 60 includes cutting edges 68 as defined by the junctures of the edge surfaces 64 with the side 62. The insert also includes cutting edges 70 as defined by the junctures of the edge surfaces 66 and the side faces 62: The insert 60, therefore, has eight cutting edges which are defined by the junctures of the edge surfaces and the side faces. Only one is shown, but each side face 62 has a recess 72 disposed therein to define and extend between the four raised portions 74. The raised portions 74 join one another to form a continuous raised portion about the periphery of the side 62. As discussed in connection with the description of the insert 16, the upper surfaces of the respective raised portion 74 of the insert 60 may be inclined in either direction from the associated cutting edges to form an acute angle with the recess 72 for providing a positive or negative rake.

The insert 60 not only has a substantially H-shaped cross section as defined by a plane perpendicular to the cutting edges 68 and passing through the insert, but is also substantially H-shaped in cross section as defined by a second plane perpendicular to the first plane and perpendicular to the cutting edges 70 and passing through the insert. The insert 60 includes a hole 76 for receiving an appropriate fastening means to secure the insert in a pocket in a shank, and, as discussed in connection with the description of the insert 16, any appropriate well-known fastener may be utilized for this purpose.

It is to be understood that the proportion between the respective areas of the edge surfaces and the sides are only illustrative and may vary in accordance with the particular insert and the manner it is to be mounted in a shank or other cutting tool. More specifically, each of the surfaces 34 of the insert 16 are illustrated as having an area greater than any one of the surfaces 30, 32 or 36 and the surfaces of largest area are frequently referred to as "sides"; however, the surfaces 30 and 32 are referred to hereinabove as sides for convenience of description to establish uniformity in describing the various embodiments and the terms are not to be regarded as limiting. Additionally, it will be understood that the depth of the recesses and, hence the depth of the raised portions, may vary. In fact, in practice the recesses are very shallow, on the order of from 0.002 to 0.010 or possibly 0.020 inches.

WHAT WE CLAIM IS:—

1. An invertible and indexable insert, including a pair of spaced substantially parallel sides and a peripheral surface disposed therebetween comprising a plurality of flat edge surfaces, at least some of the junctures of said flat edge surfaces with said parallel sides defining straight cutting edges, said insert having a flat-surfaced planar recess on both of said sides extending between raised portions of said sides, the cutting edges being at the peripheral edge of the raised portions of said parallel sides.

2. An insert as claimed in claim 1 in which each of the raised portions of said sides includes a flat upper surface which is perpendicular to its associated edge surface.

3. An insert as claimed in claim 1 in which each of said raised portions of said sides includes a flat upper surface extending from the associated cutting edge towards the adjacent recess at an acute angle with the recess.

4. An insert as claimed in claim 1, 2 or 3, having four flat edge surfaces, a first pair of which are parallel to one another and a second pair of which are parallel to one another and perpendicular to and interconnect with said first pair of edge surfaces, said insert having a substantially H-shaped cross section as defined by a plane perpendicular to a cutting edge thereof and passing through the insert.

5. An insert as claimed in claim 1, 2, 3 or 4, having a total of four cutting edges, two on each side, formed by the junctures of said flat edge surfaces with said parallel sides.

6. An insert substantially as described with reference to and as illustrated in the accompanying drawings.

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1154754 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

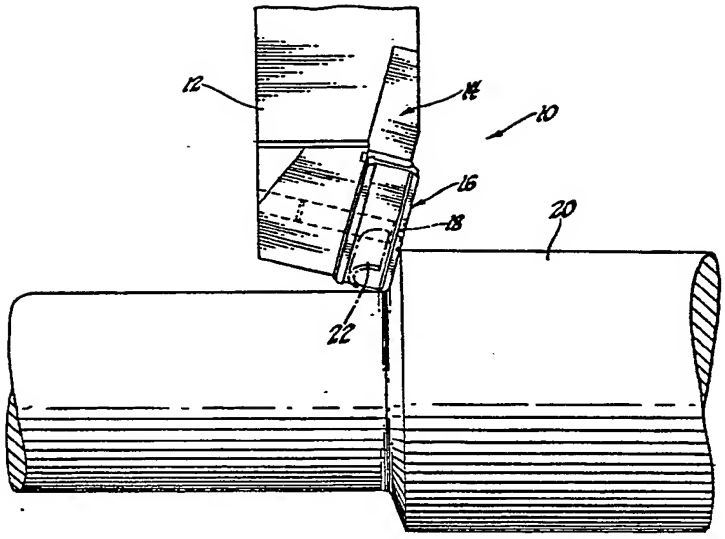

Fig. 1

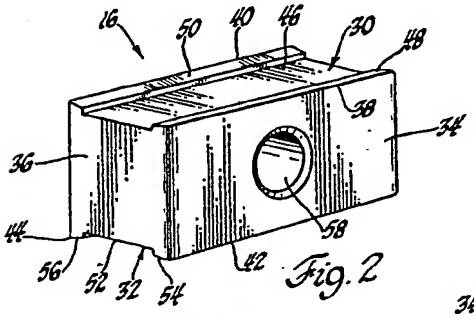

Fig. 2

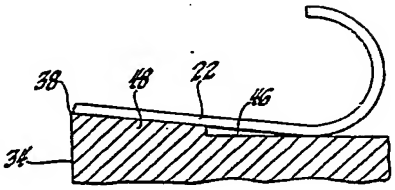

Fig. 3

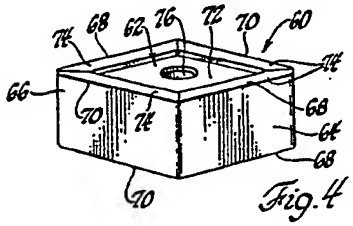

Fig. 4